General

Vasectomy Regret or Lack Thereof

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Background

Vasectomy is a procedure that results in permanent yet reversible sterility and remains a great contraceptive option for many. Previous research studies have highlighted frequency of vasectomy utilization, defining characteristics of individuals who opt for this method, various surgical techniques, and the risks and benefits associated with the procedure. What remains to be defined is why or why not individuals may experience post-vasectomy regret and whether the previous characteristics correlate.

Objective

The objective of this review is to synthesize information regarding reasons individuals may regret their vasectomy and seek reversal, what options exist for accomplishing the reversal, and patients' fertility prognosis post-vasovasostomy.

Methods

This review utilized a combination of secondary and tertiary data analysis across a wide scope of academic databases pertaining to the topic of interest.

Results

Typically, most males who have sought a vasectomy are satisfied with their decision, however, approximately 6% of this population seeks reversal. Key factors influencing vasectomy regret include age at the time of vasectomy, parental status, pre- and post-operative relationship status, unresolved physical and psychosexual problems, and development of chronic scrotal pain following the procedure. Few options exist for vasectomy reversal including microsurgical reconstructive vasectomy reversal (VR) and sperm extraction for in vitro fertilization. There is no guarantee that fertility will be restored in any case but a major predictive factor for success is the time interval prior to reversal.

Conclusion

Vasectomy is intended to be a permanent form of contraception; however, a minor chance remains that individuals may experience post-operative regret due to various factors. This warrants proper comprehensive counseling by the patient's provider

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regarding benefits and risks, procedural outcomes, opportunities for reversal, and fertility prognosis.

INTRODUCTION

Vasectomy is a widely available, safe, and effective form of male contraception that helps to ease the contraceptive burden on females while simultaneously offering males the opportunity to take a more active role in pregnancy prevention. Vasectomy is the fourth most utilized method of pregnancy prevention preceded by oral contraceptives (30.6%), female sterilization (27.0%), and male condoms (18.0%).[1, 2] Trends demonstrated dramatic increases in male sterilization between 1965 and 1976[3] and a marked decline in vasectomies between 2002 and 2017[1,4,5] which could be attributed to a multitude of factors including periods of economic uncertainty.[1,4] Despite numbers trending downward, it still appears that approximately half a million men in the United States (US) choose to undergo this procedure annually.[6]

Given the permanence and subsequent challenges posed by vasectomy reversal, proper counseling for individuals seeking vasectomies and involved partners is warranted. Critical information to be discussed with patients includes, but is not limited to, other forms of contraception, understanding that the procedure results in permanent sterility, future family intent, risk of pregnancy, and future therapeutic approaches such as sperm extraction for use in in vitro fertilization and vasectomy reversal.[2,6-8]

Few studies have investigated characteristics of individuals seeking vasectomy reversal along with other predictive factors. One notable factor is age; men seeking vasectomy reversal tended to have undergone the initial procedure earlier than men not seeking reversal.[2,9] This article seeks to uncover regret, or lack thereof, in individuals who have chosen vasectomy as a form of contraception and options for those who seek reversal.

VASECTOMY OVERVIEW

WHAT IS A VASECTOMY?

A vasectomy is a surgical procedure that can be performed in an outpatient setting, typically by a urologist, utilizing local anesthesia.[2] The purpose of this procedure is to divide and occlude the vas deferens which cuts off the supply of sperm to the ejaculate fluid.[7,10] Sperm makes up a small fraction of the ejaculate volume, therefore there will generally be no perceivable changes in the amount of ejaculate post-operatively.[10]

Vasectomy is a permanent form of contraception relied upon by both males and females as an alternative to other long-acting methods such as tubal sterilization.[11] Studies have demonstrated that three of the most cost-effective contraceptives in the US are the copper-T IUD, vasectomy, and the Levonorgestrel intrauterine system (LNG-20 IUS) when factors such as the cost of unintended pregnancy are accounted for.[12] Other benefits to this method include being a reliable method of contraception with only about a 1/2000 chance of failure, a one-time cost that may be covered by insurance, minimal to no effects on sexual pleasure, and association with shorter operation and recovery time as opposed to tubal ligation.[2,7,13] Overall, this method persists as a safe, effective option that helps relieve the contraceptive burden on females.[14]

PREVALENCE OF VASECTOMIES IN THE US

Over the last two decades, vasectomy utilization among men aged 18-45 has decreased according to National Survey of Family Growth (NSFG), with the biggest decrease amongst the lowest and highest age groups.[1,5] It remains a more common method of contraception in developed Western countries such as the US, Canada, and the United Kingdom as opposed to many Asian and Latin American countries.[1,5] Within the US, vasectomies tend to be more highly utilized in Western and North Central regions with no significant difference in rural versus non-rural areas.[5] Additionally, temporal trends have demonstrated increases in the number of vasectomies performed during the month of March (for March Madness) and at the end of the year which correlate to more time off and accumulation of insurance premiums.[5]

DEMOGRAPHICS AND VASECTOMY UTILIZATION

Characteristics have been associated with individuals seeking and opting to undergo vasectomies. From 2002-2017, studies show that the average age of men seeking a vasectomy remained stable around the 31–33-year age range whereas the average age of men at the time of their last child showed a steady increase.[1] Studies have investigated the differences in men who were childless at the time of vasectomy versus men who previously had children in which most demographic information was extremely similar. Factors that set these two groups apart, however, included larger income, less religious affiliation and more geographic mobility amongst the childless group.[3] There was also no difference in styles of psychological adjustment or marital satisfaction following the procedure, and this operation appeared to be not only physically, but also psychologically safe for men with and without children.[3] Over time, however, a growing correlation has appeared between the number of men seeking this form of contraception and the number of offspring that they have.[1]

Positive associations found with the use of vasectomy included factors such as increased age, non-Hispanic white race, marital status, higher levels of education, lack of Catholic religious affiliation, and possession of private health insurance.[1,5,15] Individuals born in the US are also more likely to undergo the procedure as opposed to immigrant populations, and studies demonstrated notable disparities in the number of Hispanic and black men that utilize this option.[1,5,15] A strong positive correlation exists between vasectomies and higher socioeconomic status, specifically with total household incomes that meet or exceed $50,000 annually.[1] While it is less common for men

under the age of 25 to undergo this procedure, any individual with the ability to provide informed consent can opt to do so following proper counseling by a provider.[7]

SURGICAL TECHNIQUES

While approximately 30 different methods of isolation of the vas deferens and occlusion of the vas exist, there are two main vasectomy surgical techniques that are important to discuss, conventional versus no-scalpel methods.[2,7,8,13,14,16] The conventional vasectomy technique requires bilateral scrotal incisions which allows for access to and transection of the vas deferens, a less popular technique in the US.[2,8,14] The no-scalpel method, or minimally invasive vasectomy (MIV) is now more highly recommended due to improved outcomes such as shorter operation times, less bleeding and risk of infection, hematoma, less peri- and post-operative pain, and a quicker resumption to sexual activity.[7,16] The MIV consists of a small puncture through the scrotal skin with a sharp forceps-like instrument, externalization of the vas deferens and subsequent transection.[2,7,8,14] A difference in the effectiveness of these two methods has yet to be identified.[16]

Once transected, there are multiple methods by which the vas deferens can be occluded. Three of these divisional methods include mucosal cautery (MC) with fascial interposition (FI), MC without FI, and open-ended vasectomy which leaves the testicular end of the vas unoccluded and uses MC with FI on the other end.[2,8,15] Typically, ligatures and clips are avoided in this procedure. MC appears more effective than electrocautery, and FI is utilized in conjunction with MC in order to make a tissue barrier between the two vas ends thereby decreasing chances of failure.[2,8,14,15] Following a vasectomy, males should continue to use other contraceptive methods until success of the surgery has been proven via post-vasectomy semen analysis (PVSA) .[2,8,14,17] Typically, azoospermia, or lack of sperm in the semen, occurs anywhere from eight to sixteen weeks post-operatively and approximately 20 ejaculations after the procedure, but some patients may never reach this end goal and will instead persist with nonmotile sperm which may still be an indication for procedure success.[2,7,8,14,17,18]

RISKS ASSOCIATED WITH VASECTOMIES

Complications associated with vasectomies include hematoma formation, infection, post-vasectomy pain syndrome, congestive epididymitis, and sperm granuloma.[2,14,19,20] Incidence rates of infections such as Fournier's gangrene, sexually transmitted infections (STIs), and endocarditis, as well as hematoma formation are between 0.2-1.5% and 4-22%, respectively. The incidence of post-vasectomy pain syndrome is 1-14%, whereas incidence for sperm granulomas is the highest at 40%.[19,20] Vasectomies have been associated with no increased risk for other conditions such as prostate cancer, cardiovascular disease, sexual dysfunction, changes in reproductive hormones or development of antisperm antibodies.[20] A final, and, perhaps, one of the more concerning risks associated with vasectomies is failure of the procedure resulting in an unplanned pregnancy. Failure of this procedure, associated with late recanalization, unprotected sexual activity before clearance, and technical errors occurs in <1% of all cases,[2,7,21] however, patients must be aware of this possibility and follow the advice of their provider.

FACTORS INFLUENCING VASECTOMY REGRET

Given the global popularity of vasectomy as a means of contraception, there have been no shortage of studies conducted to analyze potential complications and side effects of the procedure. In general, it has been seen that serious side-effects on the patient's health, whether physical, hormonal, or psychosexual, are uncommon. The procedure is generally regarded as one of the safest and most reliable forms of contraception.[22,23] Overall, most men are satisfied with their vasectomy and tend to report either unchanged or increased levels of sexual fulfillment and intimacy with their partner.[24] Despite this, there are a small number of men who regret the procedure and may go on to seek a reversal (for reference the number of men seeking reversal is around 6%).[9] Given the small number of physical complications associated with the procedure, most of the reasons why a patient may regret having a vasectomy tend to center around personal and social factors, such as the age at which they undergo the procedure, whether they have children, or changes in their relationship status.

AGE

Young age at the time of vasectomy has been seen to correlate strongly with vasectomy regret. Specifically, those men who elect to undergo vasectomy prior to age 30-35 are much more likely to regret their decision than men who have the procedure done later in life.[25-27] One study demonstrated that men who underwent vasectomy in their 20s are 12.5 times more likely to seek a reversal than older men.[9] It has been observed that some of the regretful men in this age bracket made an impulsive decision to get a vasectomy in a state of emotional turmoil or out of reaction to a stressful situation. Examples of men fitting this profile would include those who experience an initial panic following the news of a pregnancy, those who suffer from a depressive disorder, or those who are experiencing financial difficulties. Once the crisis resolves, these men may regret their sterilization.[27]

PARENTAL STATUS

The relationship between the parental status of a man and post-vasectomy regret is multifaceted. It has been seen that, all things being equal, there are negligible differences in post-operative regret between married, voluntarily childless men and married men who fathered children pre-vasectomy.[3] Moreover, recent data analyses have shown that men who were voluntarily childless prior to vasectomy are actually less likely to undergo a vasectomy reversal than men with children (though feelings of regret were not analyzed).[28,29] This relationship is likely more complex than

it appears at first, however, as there are consistent demographic differences between voluntarily childless men and men with children. For instance, voluntarily childless men tend to be less religious and have a higher income. Among men who have children prior to vasectomy other factors come into play. Of note, there tends to be increased regret among those who have lost a child post-vasectomy.[27, 30-33] Outside of tragic circumstances such as these, some of these men that experience regret have simply changed their minds about the number of children they wish to have.[33-35] This latter reason for regret was seen to be particularly related to a couple having very young children at the time the man underwent the procedure.[25]

RELATIONSHIP STATUS

The relationship between a man and his partner both pre- and post-vasectomy can play a significant role in post-operative regret. Previously married men are more likely to regret having a vasectomy after they have gone through a divorce.[32,33] Some men have reported that they underwent a vasectomy in hopes of saving a failing marriage, only to regret the decision following the ultimate dissolution of the relationship.[27] In one retrospective questionnaire it was found that 94% of men regretting their vasectomy had entered a new relationship following the procedure.[26] Many men experiencing regret post-divorce or breakup have felt that their sterility placed them at a distinct disadvantage in pursuing new, romantic relationships. Among those divorced, post-vasectomy men who do remarry, many may feel a significant desire to father a child with their new partner.[27,33]

OTHER FACTORS CONTRIBUTING TO VASECTOMY REGRET

The characteristics discussed above tend to be the most frequent traits common to men regretting vasectomy. However, the following few are still noteworthy and may commonly overlap with both each other and previously enumerated factors. Among some patients, unrealistic expectations of what they can expect following the procedure lead to regret when these hopes fail to materialize. An example of this would be a man struggling with impotence who believes a vasectomy will cure him.[36] As noted previously, physical and psychosexual problems following vasectomy tend to be rare. However, there are a small number of men who note feelings such as “incompleteness” or inadequacy following vasectomy and believe a reversal will rid them of these feelings.[27,33,36] Finally, a small number of men can develop chronic scrotal pain, leading to procedural regret.[24,37] As is apparent, some characteristics, such as young age and marital disharmony, are identifiable signs that a man may be liable to regret their vasectomy in the future. Others, such as death of a child or chronic pain, are unfortunately unpredictable. In any case, restoral of fertility post-vasectomy is by no means guaranteed.[38] Given this, increased efforts to identify and provide targeted counsel to men at risk for post-vasectomy regret is a worthwhile endeavor.

VASECTOMY REGRET: OPERATIVE OPTIONS AND FERTILITY PROGNOSIS

VASECTOMY REVERSAL AND IN-VITRO FERTILIZATION

While vasectomy remains an effective and safe method of birth control, about 3-6% of men seek reversal of the procedure due to various circumstances, including remarriage, loss of a child, an altered financial situation, or post-vasectomy pain syndrome.[39] A patient seeking reversal should be counseled on the options for pursuing conception post-vasectomy keeping in mind that the most important prognostic factor for successful reversal is the time interval of obstruction.[40] The first option is a reconstructive vasectomy reversal (VR) procedure. Microsurgical reconstructive VR procedures remain the gold standard of treatment for vasectomy revision. Due to the complexity of the procedure, only a minority of urologists will perform the procedure, and financial barriers exist due to this procedure rarely being covered by insurance.[6] VR is achieved through reattachment of the vas deferens either through vasovasostomy, the reconnection of the two severed ends of vas deferens to each other, or vasoepididymostomy, the connection of the vas deferens directly to the epididymis. The microsurgical approach to vasovasostomy shows an increased likelihood of sperm returning to semen and postoperative pregnancy success when compared to a macrosurgical approach.[41] When evaluating the success rate of unilateral versus bilateral vasovasostomies, there was no statistical difference in the return of sperm to semen or pregnancy rate between the two surgical approaches.[42]

The second option for patients with conception-oriented vasectomy regret is sperm extraction for in vitro fertilization (IVF), which might also present a financial burden upon the patient due to the variability of insurance coverage.[6] When comparing conception-directed options, VR is more cost-effective than IVF if neither procedure is covered by insurance. IVF is a more effective option for couples seeking pregnancy post-vasectomy if a female factor of infertility is present in addition to the male’s vasectomy. Lastly, IVF may present a backup option in the event of a failed reconstructive VR in which the patient opted to cryopreserve sperm at the time of the procedure.

Pregnancy success rates are similar for both IVF and VR; therefore, the couple’s decision should involve thorough discussions with a VR experienced urologist and an IVF experienced reproductive endocrinologist.[43] In these discussions, couples should consider the fertility and age of the female partner, the number of children the couple wants, and the relative success of each procedure based on their unique situation, as these factors may alter the prognosis of VR or IVF. A patient seeking VR for psychological or pain-related reasons rather than fertility restoration should consider alternative pain management methods before surgical intervention due to the unknown pathogenesis of post-vasectomy pain syndrome and indefinite postoperative relief of pain with VR.[41] In a study of 31 patients who underwent VR for post-vasectomy pain, only 34% of patients reported complete alleviation, while 82% reported improved pain relief by the 3.2-month follow-up.[44]

FERTILITY PROGNOSIS POST-VASECTOMY

Vasectomy is a safe and reliable form of birth control, yet there is no guarantee of the ability to restore fertility in patients who seek reversal of this procedure. Data suggest that in the case of a patient seeking vasectomy reversal, fertility is only restored in about 50% of cases due to changes in the epididymis and vas anastomosis after a vasectomy. The primary causes of failed vasectomy reversal are stenosis of the previous vasovasostomy, epididymal blockage, elevated anti-sperm antibody response, and ceased spermatogenesis.[23] A study of 1469 patients who underwent microsurgical vasectomy reversal found that the interval of time between vasectomy and VR was a highly predictive factor of a patient's likelihood of successful restoration of sperm within the semen. About 97% of patients successfully restored sperm within the semen if less than three years passed between vasectomy and VR. With an interval of 3 to 8 years between procedures, that number dropped to 88%. At 9 to 14 years between procedures, only 79% of patients experienced restoration of sperm to semen.[45]

Even with the successful restoration of sperm count and motility within the semen, natural conception may remain unachievable for a patient and their partner. In a standardized analysis of fertility restoration based on a population of 95 men with healthy postoperative sperm concentration (20 x 10(6)/ml) and motility (50% or greater), only 66.6% of patients achieved pregnancy with their partner.[38] The likelihood of natural conception success post-VR can also be predicted by the time interval between vasectomy and reversal. At an interval of 3 years between vasectomy and VR, 76% of patients achieved pregnancy success. With an interval of 3-8 years between procedures, that number dropped to 53%. At an interval of 9 to 14 years, only 44% of VR patients achieved pregnancy.[45]

A viable option for patients who undergo VR, especially those facing an increased time interval between the vasectomy and VR is cryopreservation of sperm at the time of VR. In a study of VR failure followed by IVF of cryopreserved sperm from the VR procedure, 67% of patients succeeded in pregnancy via IVF.[46] In the event of initial VR failure to restore sperm to semen, repeated microsurgical VR procedures are the primary option for patients seeking natural conception success with their partner. Repeated microsurgical VR yields restoration of sperm to semen in 75% of patients and pregnancy success in about 43% of patients.[45] The likelihood of success with repeated VR procedures is positively correlated to the presence of spermatozoa in the vas deferens fluid.[47] Failure to achieve pregnancy with evidence of healthy sperm count and motility may be suggestive of partner infertility.[38]

Fertility and pregnancy success highly depends upon the female partner's age. In a study of men who underwent VR with an obstruction interval of 15 years or more, those with a female partner aged <30 years compared to those with female partners aged 36-40 years resulted in pregnancy success rates of 64% and 32% respectively. With vasectomy reversal sometimes indicated to take six months or more for sperm to return to the patient's ejaculate, VR is argued as inappropriate for conception-seeking couples facing advanced maternal age at the time of VR.[48]

CONCLUSION

Vasectomy is a rapid, cost-effective, and safe procedure utilized to obtain permanent sterility in males. While this outcome can be achieved through many methods, currently the MIV is the most highly recommended. There are proven benefits associated with vasectomies such as decreased cost as compared to other contraceptives, shorter operation and recovery times versus tubal ligation, quick return to sexual activity, and a high success rate. Factors associated with individuals opting to utilize this form of contraception include, but are not limited to, socioeconomic status, race, increased age and number of offspring, and birth location. Recent trends have demonstrated a marked decrease in the number of vasectomies being performed which can be attributed to a multitude of factors.

Individuals seeking vasectomy reversal may do so due to various factors including changes in relationship status, parental status at the time of procedure, age, and other minor factors. However, males who are above the age of 30 at the time of the procedure and who are childless tend to seek vasectomy reversals less frequently than other males. Reversal of a vasectomy may be accomplished through reanastomosis of the vas deferens that was previously ligated via microsurgical techniques. Another option for patients with post-vasectomy regret is sperm extraction for IVF. Success of the VR procedure is dependent upon the extent of the damage done at the time of the vasectomy and the duration of vas occlusion. Overall fertility and pregnancy success is also reliant upon factors such as the fertility and age of the patient's partner. Providers must properly counsel their patients, ensuring that they are aware of the benefits, risks, potential complications and long-term effects of vasectomies, thereby allowing them to make a well-informed decision.

REFERENCES

1. Zhang X, Eisenberg ML. Vasectomy utilization in men aged 18–45 declined between 2002 and 2017: Results from the United States National Survey for Family Growth data. *Andrology*. 2022;10(1):137-142. doi:10.1111/andr.13093

2. Part 2 Vasectomy - UpToDate.

3. Brown RA, Magarick RH. PSYCHOLOGIC VOLUNTARILY EFFECTS OF VASECTOMY IN CHILDLESS MEN.

4. Punjani N, Goldstein M. Vasectomy: is the apparent decline real or not? doi:10.1111/andr.13093

5. Ostrowski KA, Holt SK, Haynes B, Davies BJ, Fuchs EF, Walsh TJ. Evaluation of Vasectomy Trends in the United States. *Urology*. 2018;118:76-79. doi:10.1016/j.urology.2018.03.016

6. Brannigan RE. Vasectomy and vasectomy reversal: a comprehensive approach to the evolving spectrum of care. *Fertility and Sterility*. 2021;115(6):1363-1364. doi:10.1016/j.fertnstert.2021.04.029

7. CUA BEST PRACTICE REPORT. Published online 2022. doi:10.5489/cuaj.7860

8. Sharlip ID, Belker AM, Honig S, et al. Vasectomy: AUA guideline. *Journal of Urology*. 2012;188(6 SUPPL.):2482-2491. doi:10.1016/j.juro.2012.09.080

9. Potts JM, Pasqualotto FF, Nelson D, Thomas AJ, Agarwal A. PATIENT CHARACTERISTICS ASSOCIATED WITH VASECTOMY REVERSAL. *Journal of Urology*. 1999;161(6):1835-1839. doi:10.1016/s0022-5347(05)68819-2

10. Vasectomy _ Enhanced Reader.

11. Peterson HB, Curtis KM. Long-Acting Methods of Contraception. *N Engl J Med*. 2005;353(20):2169-2175. doi:10.1056/nejmcp044148

12. Trussell J, Lalla AM, Doan QV, Reyes E, Pinto L, Gricar J. Cost effectiveness of contraceptives in the United States. *Contraception*. 2009;79(1):5-14. doi:10.1016/j.contraception.2008.08.003

13. Aradhya KW, Best K, Sokal DC. Recent developments in vasectomy. *British Medical Journal*. 2005;330(7486):296-299. doi:10.1136/bmj.330.7486.296

14. Schwingl PJ, Guess HA. Safety and Effectiveness of Vasectomy. *Fertility and Sterility*. 2000;73(5):923-936. doi:10.1016/s0015-0282(00)00482-9

15. Dassow P, Bennett JM. Vasectomy: An Update. Published 2006. http://www.aafp.org/afp

16. Cook LA, Pun A, Gallo MF, Lopez LM, van Vliet HAAM. Scalpel versus no-scalpel incision for vasectomy. *Cochrane Database of Systematic Reviews*. 2014;2014(3). doi:10.1002/14651858.cd004112.pub4

17. Bhatta Dhar N, Jones JS. Vasectomy: A Simple Snip?

18. Hancock P, McLaughlin E. British Andrology Society guidelines for the assessment of post vasectomy semen samples (2002). *Journal of Clinical Pathology*. 2002;55(11):812-816. doi:10.1136/jcp.55.11.812

19. Awsare NS, Krishnan J, Boustead GB, Hanbury DC, Mcnicholas TA. Complications of vasectomy. *Ann R Coll Surg Engl*. 2005;87(6):406-410. doi:10.1308/003588405x71054

20. Yang F, Li J, Dong L, et al. Review of vasectomy complications and safety concerns. *World J Mens Health*. 2020;39(3):406. doi:10.5534/wjmh.200073

21. Jamieson DJ, Costello C, Trussell J, Hillis SD, Marchbanks PA, Peterson HB. The risk of pregnancy after vasectomy. *Obstetrics & Gynecology*. 2004;103(5, Part 1):848-850. doi:10.1097/01.aog.0000123246.11511.e4

22. Kovacs GT, Frances M. Vasectomy: What are the long-term risks? *Medical Journal of Australia*. 1983;2(11):564-567. doi:10.5694/j.1326-5377.1983.tb122678.x

23. HENDRY WF. Vasectomy and vasectomy reversal. *British Journal of Urology*. 1994;73(4):337-344. doi:10.1111/j.1464-410x.1994.tb07592.x

24. Moss WM. Attitudes of patients one year after vasectomy Results of 355 of 1,000 questionnaires. *Urology*. 1975;6(3):319-322. doi:10.1016/0090-4295(75)90754-2

25. Ehn BE, Liljestrand J. Experiences of legal sterilization in Scandinavia. *Contraception*. 1993;48(2):157-167. doi:10.1016/0010-7824(93)90006-s

26. Rungby J, Dahl H, Krogh J, Kvist E. Vasectomy: who regrets it and why? *Ugesky Laeger*. 1994;156(16):2377-2380.

27. Howard G. Who asks for vasectomy reversal and why? *BMJ*. 1982;285(6340):490-492. doi:10.1136/bmj.285.6340.490

28. Bryk DJ, Murthy PB, DeWitt-Foy M, et al. Childless Men at the Time of Vasectomy are Unlikely to Seek Fertility Restoration. *Urology*. 2020;136:142-145. doi:10.1016/j.urology.2019.12.003

29. Najari BB, Persily JB, Peterson JC, Wells MT, Goldstein M. Vasectomy in Men without Children: Demographics and Family Planning Attitudes from the National Survey for Family Growth. *Urology Practice*. 2021;8(1):125-130. doi:10.1097/upj.0000000000000150

30. Wolfers H, Subbiah N, bin Mazurka A. Psychological aspects of vasectomy in Malaysia. *Social Biology*. 1973;20(3):315-322. doi:10.1080/19485565.1973.9988060

31. Goebel P. On the development of desire for refertilization among vasectomized men. *Prax Psychother Psychosom*. 1988;33(6):310-320.

32. Jenkins IL, Blacklock NJ. Reversal of Vasectomy. *International Journal of Gynecology & Obstetrics*. 1979;17(2):144-147. doi:10.1002/j.1879-3479.1979.tb00138.x

33. Clarke L, Gregson S. Who has a vasectomy reversal? *J Biosoc Sci*. 1986;18(3):253-259. doi:10.1017/s0021932000016229

34. Ekman Ehn B, Liljestrand J. A Long-Term Follow-up of 108 Vasectomized Men. *Scandinavian Journal of Urology and Nephrology*. 1995;29(4):477-481. doi:10.3109/00365599509180030

35. Henshaw SK, Singh S. Sterilization Regret Among U.S. Couples. *Family Planning Perspectives*. 1986;18(5):238. doi:10.2307/2134990

36. Bloom LJ, Houston BK. The Psychological Effects of Vasectomy for American Men. *The Journal of Genetic Psychology*. 1976;128(2):173-182. doi:10.1080/00221325.1976.10533987

37. Manikandan R, Srirangam SJ, Pearson E, Collins GN. Early and late morbidity after vasectomy: a comparison of chronic scrotal pain at 1 and 10 years. *BJU Int*. 2004;93(4):571-574. doi:10.1111/j.1464-410x.2003.04663.x

38. Sharlip ID. What is the Best Pregnancy Rate that may be Expected from Vasectomy Reversal? *Journal of Urology*. 1993;149(6):1469-1471. doi:10.1016/s0022-5347(17)36417-0

39. Patel A, Smith R. Vasectomy reversal: a clinical update. *Asian J Androl*. 2016;18(3):365. doi:10.4103/1008-682x.175091

40. Lipshultz LI, Rumohr JA, Bennett RC. Techniques for Vasectomy Reversal. *Urologic Clinics of North America*. 2009;36(3):375-382. doi:10.1016/j.ucl.2009.05.011

41. Vasectomy reversal. *Fertility and Sterility*. 2008;90(5):S78-S82. doi:10.1016/j.fertnstert.2008.08.097

42. Yahyazadeh SR, Sadighi Gilani MA, Karimi A. Vasectomy reversal: Unilateral versus bilateral vasovasostomy. *Andrologia*. 2021;53(9). doi:10.1111/and.14178

43. Dubin JM, White J, Ory J, Ramasamy R. Vasectomy reversal vs. sperm retrieval with in vitro fertilization: a contemporary, comparative analysis. *Fertility and Sterility*. 2021;115(6):1377-1383. doi:10.1016/j.fertnstert.2021.03.050

44. Polackwich AS, Tadros NN, Ostrowski KA, et al. Vasectomy Reversal for Postvasectomy Pain Syndrome: A Study and Literature Review. *Urology*. 2015;86(2):269-272. doi:10.1016/j.urology.2015.04.013

45. Belker AM, Thomas AJ, Fuchs EF, Konnak JW, Sharlip ID. Results of 1,469 Microsurgical Vasectomy Reversals by the Vasovasostomy Study Group. *Journal of Urology*. 1991;145(3):505-511. doi:10.1016/s0022-5347(17)38381-7

46. Marinaro J, Hayden RP, Shin P, Tanrikut C. The Utility of Sperm Cryopreservation at the Time of Vasectomy Reversal. *Journal of Urology*. 2021;205(1):236-240. doi:10.1097/ju.0000000000001319

47. Lorenzini MS, Lorenzini F, Bezerra CA. Vasectomy re-reversal: effectiveness and parameters associated with its success. *International Braz J Urol*. 2021;47(3):544-548. doi:10.1590/s1677-5538.ibju.2020.0310

48. Hayden RP, Li PS, Goldstein M. Microsurgical vasectomy reversal: contemporary techniques, intraoperative decision making, and surgical training for the next generation. *Fertility and Sterility*. 2019;111(3):444-453. doi:10.1016/j.fertnstert.2019.01.004